MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI-627 012, TAMILNADU, INDIA

CENTRE FOR INFORMATION TECHNOLOGY AND ENGINEERING

Board of Studies Meeting Held on 31.03.2016

M.Tech. in Computer and Information Technology
(CBCS-University Department)

Regulations, Scheme and Syllabus
For those who joined from the academic year 2016-2017 onwards

Submitted by
Chairman, BOS and Head i/c,
Centre for Information Technology and Engineering,

to

The Registrar
Manonmaniam Sundaranar University
Tirunelveli - 12

MANONMANIAM SUNDARANAR UNIVERSITY
TIRUNELVELI-627 012, TAMILNADU, INDIA

Centre for Information Technology and Engineering
M.Tech. in Computer and Information Technology
(CBCS-University Department)

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A. REGULATIONS

M.Tech. degree programme in Computer and Information Technology exposes students to a wide range of advanced IT courses, combined with specialized research which culminates in a thesis. Such a combination gives students the breadth and depth necessary for pursuing careers in academics as well as industry.

A1: Duration of the Course:

The M.Tech. Programme is a full time 2 year programme spread over four semesters.

A2: Eligibility for Admission:

The minimum eligibility conditions for admission to the M.Tech. Programme in Computer and Information Technology are given below.

The candidates who seek admission into the first semester of the M.Tech. Programme in Computer and Information Technology course will be required to have qualified for the Bachelor's degree in Engineering/Technology in any one of the following disciplines

1. Information Technology
2. Information and Communication Technologies
3. Computer Science & Engineering
4. Electronics and Communications Engineering
5. Electronics and Instrumentation Engineering
6. Electronics and Electrical Engineering
7. Any discipline in Engineering/ Technology with at least one compulsory theory and practical course in Computer Engineering/ Information Technology

(Or)

Master of Science (M.S. or M.Sc. or M.Sc.Engineering) degree in any one of the following disciplines

8. Information Technology and E-Commerce
9. Information Technology
10. Computer Science
11. Any combination of the above disciplines
12. M.Sc. in Mathematics/Physics/Applied Physics/Statistics/Operations Research / Electronics/Electronic Science/Computer Electronics/Software Engineering (2yrs&5yrs)/Networking & IT

13. MCA.
14. AMIE or Grad.IETE or equivalent
15. DOEACC 'B' Level qualification (MCA Level) of DOEACC Society of Ministry of Communications and Information Technology, Govt. of India.
16. And any other degree which is recognized by Manonmaniam Sundaranar University as equivalent thereto for the above said degrees to get admission for M.Tech Programme

The applicant must have a sufficient background in Information Technology to complete the degree requirements with reasonable performance.

The candidates with a valid GATE score in any of the disciplines mentioned in eligible subjects will be given priority over non-GATE candidates.

Credit Transfer for M.E./M.Tech holders in circuit branches/ DOEACC 'C' Level (M.Tech. level) qualified candidates and other equivalent qualification holders to get admission in to the M.Tech. degree in Computer and Information Technology: Candidates who have qualified the DOEACC 'C' Level (M.Tech. level) or M.E./M.Tech. in Information Technology related branches or any other equivalent qualification can apply for the award of M.Tech. Degree in Computer and Information Technology degree awarded by Manonmaniam Sundaranar University through credit transfer programme. The board of studies in Information Technology and Engineering will identify the list of equivalent papers qualified by the candidate and specify the list of additional papers to be qualified for the award of M.Tech. degree in Computer and Information Technology provided the candidate possesses at least 50% transferable credits which will be decided only by the board of studies in Information Technology and Engineering. The prospective candidate should pay one semester fee along with the usual admission fee and other fee applicable through the department. On getting admission, the candidate has to pay the examination fee and register for the list of identified papers to be qualified. No formal classes

will be available for such candidates who have to appear for the university examinations directly for those identified papers. Their external marks alone will be taken into consideration for the award of the degree, meaning that their internal marks will be the same as the external marks obtained in the final mark statement.

A3: Course Requirement for the Degree:

The University requirement for the M.Tech., Programme is completions of 90 credits of course work, out of which 5 credits should be through the mini project, 15 credits should be through the M.Tech., PG major project work. A typical theory course is normally considered to be 4 credits and lab course weighs 5 credits. No candidate will be eligible for the Degree of Master of Technology in Computer and Information Technology, unless she/he has undergone the prescribed courses of study for a period not less than 4 semesters for full-time studies and has acquired 90 credits and other passing requirements in all subjects of study. The marks, M_i obtained by the student in each subject, i shall be multiplied by the credit of that subject, C_i; such marks of all 'n' subjects are added up and divided by the total credit (90) to obtain the Consolidated Percentage of Marks.

$$\text{Consolidated Percentage of Marks} = \frac{\sum_{i=0}^{n} C_i \times M_i}{\sum_{i=0}^{n} C_i}$$

A4: Specializations:

The M.Tech. degree programme in Computer and Information Technology will have four specializations, namely

Specialization A. Image Processing and Computer Vision
Specialization B. Communication and Networking Technologies
Specialization C. Data Science and Big Data Analytics
Specialization D. Mobile Applications and Open Source Software

The degree will be offered as M.Tech., in Computer and Information Technology only. However, the subjects for Specialization A, Specialization B, Specialization C and Specialization D are offered under Group A, Group B, Group C and Group D respectively. A student can choose electives from either of four groups only. The Mini-project and Major project are also to be done in the chosen specialization only.

A5: Attendance Requirements:

A candidate will be permitted to appear for the semester examination only if the candidate keeps not less than 75 percent attendance in each subject. The University condonation rules are applicable for those who lack minimum of 75% attendance. The candidates with less than 60% attendance will have to repeat the concerned entire semester.

A6: Assessment

The assessment will comprise Continuous Internal Assessment (CIA) carrying a maximum of 50% marks and end-semester Examination carrying a maximum of 50% marks in each subject of study including Project work.

Semester examination will be conducted for all subjects of study, at the end of each Semester.

If a Student wants to carry out the final project work in 4th semester in an IT company, the student can get permission from the concerned Project Supervisor and Head of the Department after submitting the Acceptance Letter from the IT Company.

A7: Passing Requirements:

A candidate who secures not less than 50 percent marks in end-semester examination and not less than 50 percent of the total marks (Continuous Internal Assessment + end-semester examination) in any subject of study will be declared to have passed the subject.

A Candidate who successfully completes the course and satisfies the passing requirements in all the subjects of study and curricular requirements will be declared to have qualified for the award of the Degree.

A8: Classification of successful candidates

The candidates who passed written papers, practical papers and Projects shall be classified as follows. Total Marks secured in written papers, practical papers and Project work altogether put as overall percentage along with the credits.

The classification is as follows,

Marks Overall %	Classification
1. 75% and above with a First attempt pass in all subjects	I Class with Distinction
2. i) 75% above from multiple attempts	I Class
ii) 60% to below 75%	I Class

3. 50% to below 60%   II Class

A9: Academic Session

The academic year normally begins in July every year and ends in April.

These regulations will come into effect from the academic year 2016-2017 onwards.

B.SCHEME FOR M.Tech. (COMPUTER AND INFORMATION TECHNOLOGY)
(For those who joined from the academic year 2016-2017 onwards)

Sem-ester	Title of the Subject	Status*	Hrs/ week	Credits	Maximum Marks			Passing Minimum	
					Inte-rnal	Exte-rnal	Total	Exte-rnal	Total
FIRST SEMESTER									
I	Recent Trends in Information Technology	C	4	4	50	50	100	50	50
I	Advanced Computer Architecture and Organization	C	4	4	50	50	100	50	50
I	Modern Operating Systems	C	4	4	50	50	100	50	50
I	Algorithm Analysis and Design	C	4	4	50	50	100	50	50
I	Object Oriented Programming	C	4	4	50	50	100	50	50
I	Software Design and Development Laboratory (includes Advanced Computer Architecture, Operating systems, computer networks, Algorithm Analysis & Programming using C, C++ , Java, C# , VB and .NET Languages)	L	10	5	50	50	100	50	50
I Semester Total Credits				**25**					
SECOND SEMESTER									
II	Data and Computer Communication	C	4	4	50	50	100	50	50
II	Advanced Database Management Systems	C	4	4	50	50	100	50	50
II	Advanced Computer Graphics and Multimedia	C	4	4	50	50	100	50	50
II	Elective 1	E	4	4	50	50	100	50	50
II	Elective 2	E	4	4	50	50	100	50	50
II	Specialization based programming Laboratory	L	10	5	50	50	100	50	50
II Semester Total Credits				**25**					

					Maximum Marks			Passing Minimum	

THIRD SEMESTER

					Internal	External	Total	External	Total
III	Engineering Research Methodology	C	4	4	50	50	100	50	50
III	Elective 3	E	4	4	50	50	100	50	50
III	Elective 4	E	4	4	50	50	100	50	50
III	Elective 5	E	4	4	50	50	100	50	50
III	Elective 6	E	4	4	50	50	100	50	50
III	Mini Project	P	10	5	50	50	100	50	50
III Semester Total Credits				**25**					

FOURTH SEMESTER

IV	Major Project	P	30	15	50	50	100	50	50
IV Semester Total Credits				**15**					
OVERALL TOTAL CREDITS				**90**					

GROUP A: Subjects for Electives under Specialization A: Image Processing and Computer Vision

Sl. No.	Title of the Subject	Status	Hrs/week	Credits	Maximum Marks			Passing Minimum	
					Internal	External	Total	External	Total
A1	Advanced Digital Signal and Image Processing	E	4	4	50	50	100	50	50
A2	Pattern Recognition and Image Analysis	E	4	4	50	50	100	50	50
A3	Artificial Neural Networks	E	4	4	50	50	100	50	50
A4	Fuzzy Logic and Engineering Applications	E	4	4	50	50	100	50	50
A5	Data Compression	E	4	4	50	50	100	50	50
A6	Robotics	E	4	4	50	50	100	50	50

GROUP B: Subjects for Electives under Specialization B: Communication and Networking Technologies

B1	Modern Communication System	E	4	4	50	50	100	50	50
B2	Network Design	E	4	4	50	50	100	50	50
B3	High Performance Computing Networks	E	4	4	50	50	100	50	50
B4	Pervasive, Grid and Cloud Computing	E	4	4	50	50	100	50	50

B5	Mobile and Cellular Computing	E	4	4	50	50	100	50	50
B6	Network Programming	E	4	4	50	50	100	50	50
B7	Network Security	E	4	4	50	50	100	50	50

GROUP C: Subjects for Electives under Specialization C: Data Science and Big Data Analytics

C1	Big Data Analytics	E	4	4	50	50	100	50	50
C2	Programming for Data Analytics	E	4	4	50	50	100	50	50
C3	Computing for Data Analytics	E	4	4	50	50	100	50	50
C4	Cloud Computing	E	4	4	50	50	100	50	50
C5	Big Data Security	E	4	4	50	50	100	50	50
C6	Soft Computing	E	4	4	50	50	100	50	50
C7	Data Mining and Warehousing	E	4	4	50	50	100	50	50

GROUP D: Subjects for Electives under Specialization D: Mobile Applications and Open Source Software

D1	Mobile Applications Development	E	4	4	50	50	100	50	50
D2	Mobile Computing	E	4	4	50	50	100	50	50
D3	Open Source Software	E	4	4	50	50	100	50	50
D4	Android Mobile Application Development	E	4	4	50	50	100	50	50
D5	Open Source Technologies	E	4	4	50	50	100	50	50
D6	Mobile and Wireless Security	E	4	4	50	50	100	50	50
D7	Mobile and Digital Forensics	E	4	4	50	50	100	50	50

*C-Core, L-Lab, S-Supportive, E-Elective, P-Project

C. SYLLABUS FOR M.Tech. (COMPUTER AND INFORMATION TECHNOLOGY)

	RECENT TRENDS IN INFORMATION TECHNOLOGY

UNIT I
AMPS: Evolution – Components – Network Access - Frequency utilization – Channel utilization – Signaling – Voice Channel Signaling co channel signaling - Data over AMPS Case study and lessons learned – Operating rates-cellular ready modem protocols - D-AMPS: TDMA-advantages – Disadvantages – Digital radio – Voice coding methods – Channel banks – PCM – TDM and line driver – Waveform coding – Voice coding – Hybrid coding – Modulation – Baud

rate- TDM operation – Frames – Time slot format – Digital channel traffic signaling – Control channel operations – the IS –136 digital control channel – PCS overview- Extended battery life – Frequency utilization – Logical channels – Super frames and hyper frames –the PCS layered model – PCS messaging – Modem operations.

UNIT II

GSM : Frequency allocation – governing body – GSM services – voice transport – data services – bearer services – teleservices – supplementary services – the subscriber identity module- frequency allocation –initial European GSM – united kingdom GSM – PCS 1900- TDMA operations- time slot utilization – speech coding – framing and channel organization – the GSM multiframe -data over GSM –modem incompatibility – adapter useinformation transfer modes – inbound data fax – data compression – short message service – features – utilization- SMS centers – using the internet - CDMA: CITA requirements – deployments – IS 95- comparison with AMPS and TDMA -capacity – frequency allocation – speech coding – channel structure – down link channels – up link channels –

UNIT III

The WAP Protocol suite: Basic components – Architecture – Wireless Datagram Protocol - Port number use – The adaptation layer – Protocol operation – Wireless Transport Layer Security – Connection Management – Encryption support –Local Multipoint Distribution Service : Frequency allocation – Frequency Blocks, bands – Band width capacity – Architecture – Frequency considerations – The LMDS cell- Base station – the network interface unit – Access methods - Modulation- system capacity – FDMA –TDMA- Increasing cell capacity – LMDS advantages – Disadvantages.

UNIT IV

Multichannel multipoint distribution system : Frequency band – Potential Market –basic Architecture – Advantages of use – Potential Disadvantages – MDS –MMDS – Frequency Assignments – Transmission Methods – Multipath Communications – Minimizing Multipath Reflections - Blue Tooth - Wireless Lans: General characteristics – spread spectrum technology – applications- the IEEE 802.11 wireless LAN standard –initial effort –frequency selection – environments – architecture – operation – wireless home networking.

UNIT V

Introduction- Cloud Computing- Mobile Application- User Interfaces Analytics- 3D Printing- Advanced, pervasive and invisible analytics-Context-rich systems-Smart machines-Software-defined applications and infrastructure-Web-scale IT-Risk-based security and self-protection. 5G- Fiber everywhere- virtualization, SDN & NFV- everywhere connectivity for IoT & IoE- cognitive networks, big data- Cyber Security- green communications- smarter smart phones, connected sensors- network neutrality, internet governance- molecular communications.

REFERENCE BOOKS:
1. Information Technology by Cygansky, Prentice Hall of India. Edn. ASIA
2. "Wireless and mobile Networks Architecture," by Yi –Bing Lin & Imrich Chlamatac, John Wiley & Sons, 2001.
3. "Mobile & Personnel communicationSystems and Services", By Raj Pandya, Prentice Hall India, 2001.

	ADVANCED COMPUTER ARCHITECTURE AND ORGANIZATION

UNIT – I
Computer types and classifications, functional units and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. Processor organization, general register organization, stack organization and addressing modes. Control Unit - Instruction types, formats, instruction cycles and sub cycles (fetch and execute etc), micro-operations, execution of a complete instruction. Hardwire and micro-programmed control, Basic Memory concept and hierarchy, semiconductor RAM /ROM memories, 2D & 2 1/2D memory, Cache memories, Auxiliary memories, Virtual memory, Input / Output, Peripheral devices, Modes of Data Transfer, Serial/ Parallel Communication

UNIT – II
Parallel computer models: The state of computing, Multiprocessors and multicomputers, Multivector and SIMD computers, Architectural development tracks Program and network properties: Conditions of parallelism, Data and resource dependences, Hardware and software parallelism, Program partitioning and scheduling, Grain size and latency, Program flow mechanisms, Control flow versus data flow, Data flow architecture, Demand driven mechanisms, Comparisons of flow mechanisms

UNIT – III
System Interconnect Architectures: Network properties and routing, Static interconnection networks, Dynamic interconnection Networks, Multiprocessor system interconnects, Hierarchical bus systems, Crossbar switch and multiport Memory, Multistage and combining network. Processors and Memory Hierarchy: Advanced processor technology, Instruction-set Architectures, CISC Scalar Processors, RISC Scalar Processors, Superscalar Processors, VLIW Architectures, Vector and Symbolic processors, Memory Technology: Hierarchical memory technology, Inclusion, Coherence and Locality, Memory capacity planning, Virtual Memory Technology

UNIT – IV
Backplane Bus System: Backplane bus specification, Addressing and timing protocols, Arbitration transaction and interrupt, Cache addressing models, direct mapping and associative caches. Pipelining: Linear pipeline processor, Nonlinear pipeline processor, Instruction pipeline design, Mechanisms for instruction pipelining, Dynamic instruction scheduling, Branch handling techniques, Arithmetic Pipeline Design, Computer arithmetic principles, Static arithmetic pipeline, Multifunctional arithmetic pipelines

UNIT – V
Vector Processing Principles: Vector instruction types, Vector-access memory schemes. Synchronous Parallel Processing: SIMD Architecture and Programming Principles, SIMD Computers and Performance Enhancement.

TEXT BOOKS:

1. Kai Hwang, "Advanced computer architecture"; TMH. 2000
2. D. A. Patterson and J. L. Hennessey, "Computer organization and design", Morgan Kaufmann, 2nd Ed. 2002.

REFERENCES:
1. J.P.Hayes, "computer Architecture and organization"; MGH. 1998
2. Harvey G.Cragon,"Memory System and Pipelined processors"; Narosa Publication,1998
3. V.Rajaranam&C.S.R.Murthy, "Parallel computer"; PHI. 2002
4. R.K.Ghose, RajanMoona&Phalguni Gupta, "Foundation of Parallel Processing", Narosa Publications, 2003
5. Kai Hwang and Zu, "Scalable Parallel Computers Architecture", MGH. 2001.
6. Stalling W, "Computer Organisation& Architecture", PHI. 2000
7.D.Sima, T.Fountain, P.Kasuk, "Advanced Computer Architecture-A Design space Approach,"Addison Wesley,1997.
8. M.J Flynn, "Computer Architecture, Pipelined and Parallel Processor Design"; Narosa Publishing. 1998
9. D.A.Patterson, J.L.Hennessy, "Computer Architecture :A quantitative approach"; Morgan Kauffmann feb,2002.
10. Hwan and Briggs, " Computer Architecture and Parallel Processing"; MGH. 1999.
11. Tannenbaum," Structured Computer Organization', PHI, 2002.
12. P Pal chaudhry, ' Computer Organization & Design', PHI, 2000.

	MODERN OPERATING SYSTEMS

UNIT I

Operating System Strategies : Multiprogramming System – Batch Systems – Time Sharing Systems – Personal Computers and Work stations – Process Control and Real – time Systems – Networks – The Genesis of Modern operating Systems – Using the operating System : The Abstract Model of Computing – Resources (Windows NT files and POSIX files) – other Resources – Creating Processes in Unix and Windows NT – Threads (C Threads and Windows NT Threads)

UNIT II

Operating system organization: Factors in OS Design – Basic Functions – Basic Implementation Considerations – Device Management: Device Management Approaches – Buffering – Device Drivers – Device Management Approaches – Buffering – Device Drivers – Device Management issues – Process Management: The system view of Processes and Resources – Initialising the operating system – Process address spaces – The Process Abstraction – The Resource – Abstraction – Process Hierarchy.

UNIT III

Scheduling: Scheduling Mechanisms – Strategy Selection – Nonpreemptivestratigies – Preemptive Strategies – Basic Synchronization Principles: Interacting Processes – Coordinating Processes – Semaphores – Shared Memory Multiprocessors – High-level Sychronization: Alternative Synchronization Primitives – Monitors – Interprocess communication – Explicitly Ordering Event Execution.

UNIT IV

Deadlock: Preamble – System Deadlock Model – Prevention – Avoidance – Detection and Recovery – Memory Management: Basics – Memory Allocation – Dynamic Address Relocation – Memory Management Strageties – Virtual Memory: Address Translation – Paging – Static paging Algorithms – Dynamic Paging Algorithms – Segmentation.

UNIT V

File Management: Files – Low-level file Implementations – Supporting other storage Abstractions – Memory – Mapped Files – Directories – Directory Implementation – OS Protection and Security: Authentication – Internal Access Authorization and Implementation – Cryptography – Remote Files: Sharing Information across the Network – Remote Disk Systems – Remote File systems – File - level caching – Directory systems and Their Implementations.

TEXT BOOK:
1.Operating Systems, Gary Nutt – Addison Wesly – Third Edition.

REFERENCE BOOKS:
1. Milenekovie, "Operating System Concept", McGraw Hill, 2000
2. Peterson J.L Galvin and Silberschatz A, "Operating System Concepts ", Addision Wesley,2013.
3. Dietal, "An Introduction to Operating System", Addision Wesley, 1990.
4. Tannenbaum, "Operating System Design and Implementation", PHI,2010.

	ALGORITHM ANALYSIS AND DESIGN

UNIT I

Mathematics Review, background model – Algorithm analysis – running time calculations – General rules – Solutions for the maximum subsequence sum problem – Logarithms in the running time – checking analysis.

UNIT II

Abstract Data Type (ADT) – List ADT – Array implementation of lists – Linked List – Doubly and circularly linked lists – Stack ADT – Queue ADT – Trees: Binary trees – Binary search trees.

UNIT III

Hashing: Hash function – open Hashing – Closed Hashing – Priority Queues (Heaps): Binary Heap – Applications of priority queues Sorting: Insertion Sort – Shell Sort – Heapsort – Mergesort – Quickesort.

UNIT IV

Graph Algorithms: Topological sort – Shortest Path algorithms – Network Flow Problems – Minimum Spanning tree – Application of DFS.

UNITV

Algorithm Design Techniques – Geedy Algorithms: Scheduling problem – Huffman codes – Approximate bin packing – Divide and Conquer: Running time of Divide and Conquer algorithms – Closest – Points problem – The selection problem – Theoretical Improvements for Arithmetic Problems.

REFERENCES:

1. Data Structures and Algorithms Analysis in C++ - Mark Allen Weiss: Pearson Education Asia
2. Data Structures, Algorithms and Applications in C++ - Sahni : McGraw Hill Publication.

	OBJECT ORIENTED PROGRAMMING

UNIT I

Object oriented programming concepts, Importance over Structured Programming – objects-classes- methods and messages-abstraction and encapsulation-inheritance- abstract classes-polymorphism.

UNIT II

Introduction to C++- objects-classes- constructors and destructors- Operator overloading – Functions, Returning values from functions, function overloading, friend functions- type conversions- templates - Inheritance – virtual functions-.

UNIT III

Encapsulation, Abstraction, Exception handling - Streams and formatted I/O – file handling – namespaces – String Objects - standard template library, Inheritance-Single, Mulilevel and Hierarchical Inheritance.

UNIT IV

Introduction to JAVA, bytecode, virtual machines – objects – classes – Javadoc – packages – Arrays – Strings

UNIT V
Inheritance – interfaces and inner classes - exception handling – threads - Streams and I/O, Event handling, Applets

TEXT BOOKS

1. B. Trivedi, "Programming with ANSI C++", Oxford University Press, 2007.
2. Cay S. Horstmann, Gary Cornell, "Core JAVA volume 1", Eighth Edition, Pearson Education, 2008.
3. Object Oriented Programming in C++, Pearson.
4. Java the complete reference, Herbert schildt, TMH

REFERENCE BOOKS

1. ISRD Group, "Introduction to Object-oriented Programming and C++", Tata McGraw-Hill Publishing Company Ltd., 2007.
2. ISRD Group, "Introduction to Object-oriented programming through Java", Tata McGraw-Hill Publishing Company Ltd., 2007.
3. S. B. Lippman, Josee Lajoie, Barbara E. Moo, "C++ Premier", Fourth Edition, Pearson Education, 2005.
4. D. S. Malik, "C++ Programming: From Problem Analysis to Program Design", Third Edition, Thomson Course Technology, 2007.
5. C. Thomas Wu, "An introduction to Object-oriented programming with Java", Fourth Edition, Tata McGraw-Hill Publishing Company Ltd., 2006.

	SOFTWARE DESIGN AND DEVELOPMENT LABORATORY

1. Read an integer from the keyboard and print it out if (n =>n_min AND n <= n_max) using SPIM.
2. Using SPIM Read an integer from the keyboard and print out the following as per switch-case statement
Switch (n)
{ n <= 10 print "not a lot"
n == 12 print "a dozen"
n == 13 print "a baker's dozen"
n == 20 print "a score"
n >= 100 print "lots and lots"
n != 42 print "integer"
otherwise print "you have the answer!"}
3. Using SPIM read a string from the keyboard and count the number of letters. Use the equivalent of following for loop
to count number of chars.
for (s1=0; str[s1] != '\n'; ++s1)
4. Print out a line of characters using simple procedure call using SPIM.

5. Print out a triangle of characters using recursive procedure call using SPIM.
6. Print factorial of a number using recursion using SPIM.
7. Parallel implementation Cache maemory.
8. Performing operations of Binary Adders: Half Adder, Full Adder.

9. Simulation of the CPU scheduling algorithms a) Round Robin b) SJF c) FCFS d) Priority
10. Simulation of MUTEX and SEMAPHORES.
11. Implementation of Deadlock Detection/Avoidance/Prevention in Distributed Systems.

12. Implementation of D* algorithm with spatial data structures.
13. Implement program using different forms of inheritance in C++.
14. Write a C++ program for Insertion Sort.
15. Write a C++ program for Merge sort.
16. Write a C++ program to implement the concept of virtual base class.
17. Implement Divide and Conquer Algorithm to sum an array in C++.

18. Implementation of VOIP.
19. Write a program in C to encrypt 64-bit text using DES algorithm.
20. Implementation of CRC algorithm in C.
21. Implementation of Real-Time Scheduling over the exiting Network/Distributed Systems.
22. Implementation of Dynamic Multicasting with Concurrency Control

	DATA AND COMPUTER COMMUNICATION

UNIT I
Fundamentals of Data Communications , Data Networks, and the Internet - Data Communications and Networking for Today's Enterprise - A Communications Model - Data Communications - Networks - The Internet - Protocol Architecture, TCP/IP, and Internet-Based Applications -The TCP/IP Protocol Architecture - Multimedia - Data Transmission - Concepts and Terminology - Analog and Digital Data Transmission -Transmission Impairments - Channel Capacity

UNITII
Transmission Media- Guided Transmission Media -Wireless Transmission -   Wireless Propagation - Signal Encoding Techniques - Digital Data, Digital Signals - Digital Data, Analog Signals - Analog Data, Digital Signals - Error Detection and Correction - Types of Errors - Error Detection - Parity Check - The Internet Checksum -Cyclic Redundancy Check (CRC) - Forward Error Correction - Data Link Control Protocols –Flow Control - Error Control - High-Level Data Link Control (HDLC)- Multiplexing - Frequency-Division Multiplexing - Synchronous Time-Division Multiplexing -Cable Modem - Asymmetric Digital Subscriber Line - xDSL - Multiple Channel Access

UNIT III

Wide Area Networks - Switched Communications Networks - Circuit-Switching Networks - Circuit-Switching Concepts - Softswitch Architecture - Packet-Switching Principles - Asynchronous Transfer Mode - Cellular Wireless Networks - Local Area Network - Ethernet – Wireless LANs - Internet and Transport Protocol - Principles of Internetworking - Internet Protocol Operation - Internet Protocol -IPv6 - Virtual Private Networks and IP Security - Transport Protocols

UNIT IV

Advanced Topics in Communications and Networking - Advanced Data Communications - Analog Data, Analog Signals - Forward Error-Correcting Codes - ARQ Performance Issues - Wireless Transmission Techniques - MIMO Antennas - OFDM, OFDMA, and SC-FDMA - Spread Spectrum - Direct Sequence Spread Spectrum - Code Division Multiple Access - Wireless Networks - Fixed Broadband Wireless Access - WiMAX/IEEE 802.16 - Bluetooth Overview -Bluetooth Radio Specification - Bluetooth Baseband Specification - Bluetooth Logical Link Control and Adaptation Protocol

UNIT V

Routing - Routing in Packet-Switching Networks - Internet Routing Protocols -Least-Cost Algorithms - Congestion Control - Effects of Congestion - Congestion Control - Traffic Management - Congestion Control in Packet-Switching Networks - TCP Congestion Control - Datagram Congestion Control Protocol -Internetwork Operation - Multicasting - Software-Defined Networks - OpenFlow - Mobile IP - Dynamic Host Configuration Protocol   - Internetwork Quality of Service – Multiprotocol Label Switching - Internet Applications - Electronic Mail, DNS, and HTTP - Electronic Mail—SMTP and MIME -Internet Directory Service: DNS - Web Access and HTTP.

TEXT BOOK:
1. Data and Computer Communications, William Stallings, Tenth Edition, Pearson Publications, 2014.

REFERENCE BOOKS:
1. Data Communications and Computer Networks, 7th Edition , Curt M. White, 2013
2. Data Communication and Networking, 5th Edition, Behrouz A. Forouzan, McGraw-Hill Education, 2012

	ADVANCED DATABASE MANAGEMENT SYSTEMS

UNIT I

Introduction to Database Systems: Advantages of DBMS – Describing and Storing Data in a DBMS - Queries in a DBMS – Transaction Management – Structure of a DBMS The Entity – Relationship Model: Overview of Database Design - Entities, Attributes and Entity Sets – Relationship Sets – Additional Features of the ER Model – Conceptual Databases Design with the ER Model - Conceptual Design for Large Enterprises. The Relational Model: Introduction to

the Relational Model - Integrity Constraints Over Relations - Enforcing Integrity Constraints - Querying Relational Data - Logical Database Design: ER to Relational - Introduction to Views – Destroying/Altering Tables and Views.

UNIT II

Relational Algebra and Calculus: Preliminaries - Relational Algebra - Relational Calculus - Expressive Power of Algebra and Calculus. SQL Queries: Fundamentals-Form of the basic SQL Query – Nested Queries –Aggregate Operators-Designing Active Databases-Overview of transaction management: ACID Properties-Transaction and Schedule-Concurrent Execution-Lock based Concurrency-Performance of Locking –Introduction to Crash Recovery.

UNIT III

Parallel and distributed databases- architectures for parallel databases - parallel query evaluation – data portioning – parallelizing sequential operator evolution code parallelizing individual operations – bulk loading and scanning architecture. Sorting-Joins-Parallel Query Optimization-Introduction to Distributed Databases. Types of Distributed Databases- Distributed DBMS Architectures-Client-Server Systems-Collaborating Server Systems- Middleware Systems-Storing Data in a Distributed DBMS-Fragmentation-Replication- Distributed Catalog Management- Naming Objects-Catalog Structure-Distributed Data Independence- Distributed Query Processing- Non-join Queries in a Distributed DBMS-Joins
In a Distributed DBMS- Cost-Based Query Optimization-Updating Distributed Data-synchronous Replication-Asynchronous Replication-Introduction to Distributed Transactions. Distributed Concurrency Control-Distributed Deadlock-Distributed Recovery- Normal Execution and Commit Protocols-Restart after a Failure-Two-Phase Commit Revisited-Three-phase Commit

UNIT IV

Schema Refinement and Normal Forms: Introduction to Schema Refinement-Functional Dependencies-Reasoning about FDs-Normal Forms-Properties of Decomposition-Normalization-Schema refinement in Database Design-Other kinds of Dependencies

UNIT V

OBJECT-DATABASE SYSTEMS: New Data Types- Defined Abstract Data Types- Defining Methods of an ADT-structured Types-Manipulating Data of Structured Types- Object Identity, and Reference Types- Notions of Equality-Dereferencing Reference Types- Inheritance-Defining Types with Inheritance- Binding of Methods- Collection Hierarchies, Type Extents, and Queries -Database Design for an ORDBMS-Structured Types and ADTs- Object Identity-Extending the ER Model-Using Nested Collections-New Challenges in Implementing an ORDBMS- Storage and Access Methods- Query Processing-Query Optimization.

REFERENCES:

1. DATA BASE MANAGEMENT SYSTEMS, Second Edition, Raghu Ramakrishnan, Johannes Gehrke, McGraw Hill International, 2006.
2. Data Base Management Systems, Elmashree&Navathe, Pearson Education Asia, 2008.
3. Data Base System Concepts, Schilbertz& Henry Korth, 4th Edition, McGraw Hill Publications, 2008.

	ADVANCED COMPUTER GRAPHICS AND MULTIMEDIA

UNIT – I
Basic raster graphics algorithms for drawing 2 D Primitives liner, circles, ellipses, arcs, clipping, clipping circles, ellipses & polygon.

UNIT – II
Polygon Meshes in 3D, curves, cubic & surfaces, Solid modeling.Geometric Transformation: 2D, 3D transformations, window to viewport transformations, acromatic and color models. Graphics Hardware: Hardcopy & display techniques, Input devices, image scanners.

UNIT – III
Shading Tech: Transparency, Shadows, Object reflection, Gouraud&Phong shading techniques. Visible surface determination techniques for visible line determination, Z-buffer algorithm, scanline algorithm, visible surfaces ray-tracing,and recursive ray tracing, radio-city methods.

UNIT – IV
Procedural models, fractals, grammar-based models, multi-particle system, volume rendering. Definition of multimedia, multimedia, hardware, software applications and software environments - Media Types - Analog and digital video, digital audio, music and animation - Analog & Digital video - Memory storage - Basic tools - Authoring tools.

UNIT – V
Building blocks text - hypertext - sound - sound cards - standards - image - image types - image compression, rle, jpeg, mpeg - fractal and wavelet compressions - image file types - animation - capture and playback techniques. Multimedia environments, multimedia programming, advanced multimedia moving pictures - techniques realistic image synthesis, virtual reality - full motion digital video - video capture techniques - multimedia networks - desktop video conferencing - future multimedia.

TEXT BOOKS:

1. Computer Graphics ,Schaum Series by Lipschutz (MC Graw Hill),2000
2. Hearn and P. Baker. Computer Graphics, Prentice Hall,1997
3. C.Graphics by YashwantKanetkar,2003
4. Foley et. al., "Computer Graphics Principles& practice", 2nd ed. AWL.,2000.

REFERENCES:

1. R.H. Bartels, J.C. Beatty and B.A. Barsky, "An Introduction to Splines for use in Computer Graphics and Geometric Modeling", Morgan Kaufmann Publishers Inc., 1987.
2. C.E. Leiserson, T.H. Cormen and R.L. Rivest, "Introduction to Algorithms", McGraw-Hill Book Company, 1990.
3. W. Newman and R. Sproul, "Principles of Interactive Computer Graphics, McGraw-Hill, 1973.
4. R. Plastock and G. Kalley, "Theory and Problems of Computer Graphics", Schaum's Series, McGraw Hill, 1986.
5. F.P. Preparata and M.I. Shamos, "Computational Geometry: An Introduction", Springer-Verlag New York Inc., 1985.
6. D. Rogers and J. Adams, "Mathematical Elements for Computer Graphics", MacGraw-Hill International Edition, 1989
7. David F. Rogers, "Procedural Elements for Computer Graphics", McGraw Hill Book Company, 1985.
8. Alan Watt and Mark Watt, "Advanced Animation and Rendering Techniques", Addison-Wesley, 1992.
9. David F. Rogers, Procedural Elements for Computer Graphics, McGraw Hill Book Company.
10. Multimedia Programming Objects, Environments & Framework - Simon J. Gibbs, Dionysios C. Tsischritziz (Addison-Wesley Publishing Co.)
11. Multimedia Bible - Winn L. Rosch, Sams
12. Multimedia Computing - Mathew E. Hodger& Russel M. Sasnett, Addison Wesley.

	SPECIALIZATION BASED PROGRAMMING LABORATORY

The lab exercises for different specializations shall be decided by the respective faculty member based on current trends in that area.

	ENGINEERING RESEARCH METHODOLOGY

UNIT I:
Basic research methodology: Objectives and Motivation in Research - Types of Research - Approaches and Significance of Research - Research Methodology versus Research Methods-Research Process-Finding a Research Advisor/Guide, What to Look for in a Potential
Research Advisor/Guide, How to Find an Advisor/Guide, The Advisor-Advisee Relationship;Finding a Topic and Beginning Research, Getting Research Ideas, How to be an Active Reader and Listener, Getting Exposed to Research, Directed Study; Formulating the Research Problem: Develop the Nucleus of an Idea, Extensive Literature Survey: A Trap to Avoid, Choosing an Idea, Stay Active - Measure of Good Research - Common Problems for Researchers

UNIT II:

Overview of the Theory of Science and history of scientific research - Overview of Research Methodology for Engineering Research - Science versus Engineering - Distinct perspectives of goals Research methodology for circuit branches: Formulating the Research Problem -Research Design - Evolution of Computing Research

UNIT III:
Research Methods for Engineering Research - History of ideas in computing – Measurements based research methods in computer engineering - Measurements based research methods in Signal and Image Processing, Graphics, Vision and Pattern Recognition - Deductive Methods in Computing Science

UNIT IV:
Deductive Methods in Signal and Image Processing, Graphics, Vision and Pattern Recognition - Inductive Methods in Computing Science - Inductive Methods in Signal and Image Processing, Graphics, Vision and Pattern Recognition - Building Models – Simulation

UNIT V:
Searching for scientific papers - Writing and pRecentation of a research paper for a conference or journal - Review and opposition of engineering/scientific research papers - Writing a good thesis: Research report writing - Converting your research thesis into a monograph – Research education, the research society and research policy

TEXT AND REFERENCE:
1. Lecture Notes by Prof. Dr. Krishnan Nallaperumal on "Engineering Research Methodology - A Computer Science and Engineering and Information Technology Perspective.

	MINI PROJECT

The mini-project shall be based on the chosen specialization. Internal Marks will be an average of the marks obtained from the three reviews conducted periodically by the Project Supervisor.

The student's Project Supervisor and the External examiners assigned by the HOD / projects coordinator of the department will conduct the External project presentation. The project presentation session shall be an open house session.

	MAJOR PROJECT

Objective of this course is to facilitate transfer of knowledge acquired by a student to a field of his chosen specialization for application to solving a problem. The Co-ordinator of Students' Project works from the department shall coordinate this course. Student is expected to

collect and study relevant material under mentorship of a Project Supervisor, identify a suitable problem and propose methodology towards its solution. Alternately a student can explore hardware / software implementation of existing solution(s).

The student will be tested for his understanding of basic principles of the core Specializations. The internal assessment for a total of 50 marks will be made by Project Supervisor. The Project Supervisor will conduct three reviews in each level of progress. On completion of the work, a thesis report should be prepared in the prescribed format and submitted to the department. The end-semester university examination, which carries a total of 50 marks, will have a thesis presentation and a Viva-Voce examination conducted by a committee of one external examiner and one internal examiner appointed by the HOD/Professor/ Co-ordinator of Students' Project works.

GROUP A: SUBJECTS FOR ELECTIVES UNDER SPECIALIZATION A

A1	ADVANCED DIGITAL SIGNAL AND IMAGE PROCESSNG

UNIT I
Signals and signal Processing, characterization & classification of signals, typical Signal Processing operations, example of typical Signals, typical Signals Processing applications. Time Domain Representation of Signals & Systems- Discrete Time Signals, Operations on Sequences, Linear shift-invariant systems, Frequency domain representation of discrete-time systems, symmetry properties of the Fourier transform. Discrete Fourier Transform (DFT) & its properties, computation of the DFT of real sequences.

UNIT II
Digital Image Fundamentals: Fundamental steps in Image Processing –Components of Image Processing System-Image Sampling and Quantization-Basic Relationships between Pixels. Image Enhancement in Spatial Domain: Basic Gray level Transformations-Histogram Processing- Enhancements using Arithmetic/logic Operations-Basics of Special Filtering-Smoothening Filters-Sharpening Filters.

UNIT III
Image Enhancements in the Frequency domain : Smoothening Filters-Sharpening Filters-Homomorhic Filters - Image Restoration: Degradation model –Noise Models-Restoration in the presence of Noise- Wiener Filter. Color Image Processing : Color Fundamentals-Color Models-Basics of full Color image Processing-Color Transformations.

UNIT IV

Wavelets and Multi-resolution Processing: Image Pyramids and Sub band Coding – Wavelet Transform in one dimension- FWT. Image Compressions: Fundamentals – Image Compression models – Elements of Information Theory – Error – Free Compression – Lossy compression.

UNIT V
Image segmentation: Detection of discontinuities – Edge linking and Boundary detection – Thresholding – Region Orientation Segmentation – use of motion in segmentation. Morphological Image Processing: Basic Binary morphological Operations. Basic grayscale morphological Operations. Representation and Description: Representation-Boundary Descriptors.

REFERENCES:
1. Refael C. Gonzalez & Richard E. Woods - Digital Image Processing, Addison Wesley publication corporation, 2008
2. Image Processing Analysis, and Machine Vision, Milan Sonka,
3. Alan V. Oppenheim & Ronald W. Schafer, " Digital Signal Processing" PHI, 2002
4. Sanjit K. Mitra, " Digital Signal Processing: A computer based approach" TMH, Second Edition, 2003

A2	PATTERN RECOGNITION AND IMAGE ANALYSIS

UNITI
Introduction: Machine perception, pattern recognition example, pattern Recognition systems, the design cycle, learning and adaptation.
Bayesian Decision Theory: Introduction, continuous features – two categories classifications, minimum error-rate classification-zero–one loss function, classifiers, discriminant functions, and decision surfaces.

UNIT II
Normal density: Univariate and multivariate density, discriminant functions for the normal density-different cases, Bayes decision theory – discrete features, compound Bayesian decision theory and context Maximum likelihood and Bayesian parameter estimation: Introduction, maximum likelihood estimation, Bayesian estimation, Bayesian parameter estimation–Gaussian case.

UNIT III
Un- supervised learning and clustering: Introduction, mixture densies and identifiability, maximum likelihood estimates, application to normal mixtures, K-means clustering. Date description and clustering – similarity measures, criteria function for clustering
 Pattern recognition using discrete hidden Markov models:
Discrete-time Markov process, Extensions to hidden Markov models, three basic problems of HMMs, types of HMMs.

UNIT IV

Continuous hidden Markov models: Continuous observation densities, multiple mixtures per state, speech recognition applications.

Digital image models, sampling and quantization, basic relationships between pixels, image geometry. Image enhancement: Back ground, enhancement by point processing histogram processing, spatial filtering, introduction to image transforms, image enhancement in frequency domain.

UNIT V

Image Segmentation and Edge Detection: Region Operations, Crack Edge Detection, Edge Following, Gradient operators, Compass and Laplace operators. Threshold detection methods, optimal thresholding, multispectral thresholding, thresholding in hierarchical data structures; edge based image segmentation- edge image thresholding, edge relaxation, border tracing, border detection, image morphology, image security.

TEXT BOOKS:
1. Richard O. Duda, Peter E. Hart, David G. Stroke, Pattern Classifications, Wiley, 2012
2. Lawrence Rabiner, Biing – Hwang Juang Fundamentals of Speech Recognition, Pearson, 1993.
3. Gonzalez R.C & Woods R.E., Digital Image Processing, Addison Wesley, 2009.

REFERENCES:
1. Jain A.K., Fundamentals of Digital Image Processing, Prentice Hall of India,2001.
2. Reddy M.Anji, Digital Image Processing, BS Publications.

A3	ARTIFICIAL NEURAL NETWORKS

UNIT – I:
Introduction to Neural Networks: Introduction, Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN.

UNIT- II:
Essentials of Artificial Neural Networks: Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules. Single Layer Feed Forward Neural Networks: Introduction, Perceptron Models: Discrete, Continuous and Multi-Category, Training Algorithms: Discrete and Continuous Perceptron Networks, Limitations of the Perceptron Model.

UNIT- III:
Multilayer feed forward Neural Networks: Credit Assignment Problem, Generalized Delta Rule, Derivation of Backpropagation (BP) Training, Summary of Backpropagation Algorithm, Kolmogorov Theorem, Learning Difficulties and Improvements. Associative Memories: Paradigms of Associative Memory, Pattern Mathematics, Hebbian Learning, General Concepts

of Associative Memory, Bidirectional Associative Memory (BAM) Architecture, BAM Training Algorithms: Storage and Recall Algorithm, BAM Energy Function.

UNIT IV:
Architecture of Hopfield Network: Discrete and Continuous versions, Storage and Recall Algorithm, Stability Analysis. Classical & Fuzzy Sets: Introduction to classical sets - properties, Operations and relations; Fuzzy sets, Membership, Uncertainty, Operations, properties, fuzzy relations, cardinalities, membership functions.

UNIT V:
Fuzzy Logic System Components Fuzzification, Membership value assignment, development of rule base and decision making system, Defuzzification to crisp sets, Defuzzification methods. Applications Neural network applications: Process identification, control, fault diagnosis. Fuzzy logic applications: Fuzzy logic control and Fuzzy classification.

TEXT BOOK:
1. S. Rajasekharan and G. A. Vijayalakshmipai, "Neural Networks, Fuzzy logic, Genetic algorithms: synthesis and applications", PHI Publication, 2004.
2. John Yen and Reza Langan, "Fuzzy Logic: Intelligence, Control and Information", Pearson Education,2004.

REFERENCE BOOKS:
1. Simon Haykin, "Neural Networks- A comprehensive foundation", Pearson Education, 2001.
2. S.N.Sivanandam, S.Sumathi,S. N. Deepa "Introduction to Neural Networks using MATLAB 6.0", TMH, 2006.
3. James A Freeman and Davis Skapura, Neural Networks Pearson Education, 2002.
4. Timothy J. Ross, " Fuzzy Logic With Engineering Applications", McGraw-Hill Inc. 1997.

A4	FUZZY LOGIC AND ENGINEERING APPLICATIONS

UNIT I
Introduction: background- uncertrainty and imprecision-statistics and random processes-uncertainity in information-fuzzy sets and membership –chance verus ambiguity.
Classical sets and fuzzy sets:- classical sets- operations on classical sets –properties of classical (crisp) sets – mapping of classical sets to functions fuzzy sets- fuzzy set operations-properties of fuzzy sets sets as points in hypercubes

UNIT II
Fuzzy to crisp conversions: - lambda-cuts for fuzzy sets-lambds-cuts for fuzzy relations-defuzzification methods. Fuzzy arithmetic, numbers, vectors and the extension principle:- extension principle crisp functions, mapping and relations functions of fuzzy sets –extension principle fuzzy transform- practical considerations fuzzy numbers- interval analysis in arithmetic –approximate methods of extension –vertex method –DSW algorithm –restricted DSW algorithm comparisons-fuzzy vectors

UNIT III

Classical logic and fuzzy logic:- classical predicate logic –tautologies –contradictions-equivalence-exculsion Or an exclusive Nor –logical proofs –deductive inferences fuzzy logic-approximate reasoning –fuzzy tautologies, contradictions equivalence and logical proofs-others forms of the implication operation-other forms of the composition operation. Fuzzy rule based systems: natural languages-linguistic hedges- rule based systems canonical rule forms-decomposition of compound rules –likelihood and truth qualificartion- aggrefatiuojn of fuzzy rules –graphical techniques of inference.

UNIT IV
Fuzzy nonlinear simulation: - fuzzy relationalequations-partitioning-nonlinear simulation using fuzzy rule based systems –fuzzy associative memories (FAMs)
Fuzzy decision making: fuzzy synthetic evaluation –fuzzy ordering –preference and consensus-multiobjective decision making-fuzzy Bayesian decision method-decision making under fuzzy states and fuzzy actions.

UNIT V
Fuzzy classification:Classification by equivalence relations –crisp relations-fuzzy relations-clusters analysis-cluster validity-c-means clustering –hard c-means(HCM)-fuzzy c-means (FCM)-classification metric-hardening the fuzzy c-partition-similarity relations from clustering
Fuzzy pattern recognition:- features analysis-paritions of the features space-single sample idenfication0multifeature pattern recognition –image processing-syntaticrecoginition –formal grammar-fuzzy grammar and syntactic recognition.

TEXT BOOK
1. Fuzzy logic and Engineering applications – Timothy J.Ross, 2009.

A5	DATA COMPRESSION

UNIT I
Types of data redundancies, Concepts of Information theory, Shannon's 1st Theorem, Importance of Multi-resolution Analysis, Discrete Fourier Transform, Discrete Cosine Transform, Discrete Wavelet Transform- Implementation and Importance.

UNIT II
Lossless Compression- Run length coding, Huffman Coding, Applications of Huffman Coding for Text and Audio Compression, Arithmetic Coding, Comparison of Huffman and Arithmetic Coding, Binary nd Arithmetic Coding

UNIT III
Dictionary techniques-Static Dictionary, Adaptive Dictionary, LZ coding approaches, Applications of LZ approaches for File and Image Compression.
Context based techniques-Prediction with Partial Match, Move to Front Coding based on Burrows Wheeler Transform

UNIT IV
Quantization techniques- Scalar Quantization, Forward and Backward Adaptive Quantization, Vector Quantization, Advantages of Vector Quantization over Scalar Quantization,The LBG algorithm

UNIT V
Lossy Compression and Compression Standards- Lossy predictive coding, Transform Coding, Wavelet coding, JPEG, MPEG4.

REFERENCES
1. Introduction to Data Compression, Fourth Edition, Khalid Sayood,2011
2. Anil K. Jain: Fundamentals of Digital Image Processing, Prentice Hall, 1989.
3. Rafael C.Gonzalez and Richard E. Woods: Digital Image Processing, Addison-Wesley, 1992
4.http://tcs.rwth-aachen.de/lehre/Komprimierung/SS2012/ausarbeitungen/H264-PEG4.pdf

A6	ROBOTICS

UNIT-I:
Introduction: Definition, Classification of Robots, geometric classification and control classification. Robot Elements: Drive system, control system, sensors, end effectors, gripper actuators and gripper design.

UNIT-II:
Robot Coordinate Systems and Manipulator Kinematics: Robot co-ordinate system representation, transformation, homogenous transform and its inverse, relating the robot to its world.

UNIT-III:
Manipulators Kinematics, parameters of links and joints, kinematic chains, dynamics of kinematic chains, trajectory planning and control, advanced techniques of kinematics and dynamics of mechanical systems, parallel actuated and closed loop manipulators.

UNIT-IV:
Robot Control: Fundamental principles, classification, position, path velocity and force control systems, computed torque control, adaptive control, Seroo system for robot control, and introduction to robot vision.

UNIT-V:
Robot Programming: Level of robot programming, language based programming, task level programming, robot programming synthesis, robot programming for welding, machine tools, material handling, assembly operations, collision free motion planning. Applications: Application of robot in welding, machine tools, material handling, assembly operations parts sorting and parts inspection.

TEXT/REFERENCE BOOKS:
1. CoifetChirroza, "An Introduction to Robot Technology" Kogan Page, 1983.

2. Y. Koren "Robotics for Engineers" Mcgraw Hill,1985
3. K. S. Fu, R.C. Gonzalez Y& CSG Lee, "Robotics" McGraw Hill,1987.
4. J.J. Craig, "Robotics" Addison-Wesley,2005.
5. Grover, Mitchell Weiss, Nagel Octrey, "Industrial Robots" Mcgraw Hill.
6. Asfahl, "Robots & Manufacturing Automation" Wily Eastern.

GROUP B: SUBJECTS FOR ELECTIVES UNDER SPECIALIZATION B

B1	MODERN COMMUNICATION SYSTEMS

UNIT-I: Network Evolution – The ISDN – The Basic Rat ISDN customer's Interface: The customer's Installation layer 1, 2, 3. Primary rate ISDN access: background – signaling – evaluation of PABX signaling – International standards for inter –PABX signaling.

UNIT-II: Frame mode services: Store and Forward Switching – Data grams and Virtual Circuits - Flow and Congestion Control – New ISDN Frame mode Services – Frame Format. ISDN Customer premises Equipment and Applications: High quality speech – Music coding FACSIMILE – Photographs Video tex – Video – Audio Visual services and Embedded – Customer premises Equipment.

UNIT-III: ATM Network concepts and Architecture: ATM's position in the OSI Reference Model – B-ISDN protocol reference model – ATM functions and layers – ATM signaling principles – The ATM layer – ATM switching principles.

UNIT-IV: Modern Communication: Fundamentals of Information Handling – Information media as viewed from the Human Interface – Various facets of modern Communication systems – Composition of Modern Communication systems.

UNIT-V: Components of modern Communication systems: Home systems – Home system image – Home systems and their service Trends – Access systems for Home systems. Business Communications: Basic structure of the Office system in a single office / Plant – Basic Structure of the Office system connected to WAN's. The general structure of the office system – Actual Composition of CAN and WAN. Mobile Communication in the information society- Technical Background of Mobile Communication various Mobile Communications services – Positioning of VAN – Classification by service operation mode – Classification of VAN purpose – Classification of specific Industry service type VAN's from the added value viewpoint – New Electronic Media. Construction of Global Infrastructure: Satellite Communications systems – TV Broadcasting – Approaches to meeting new goals – Possibilities of new Broadcasting forms – Information service center systems – Automatic Interpretation telephone systems – Teleconferencing systems.

TEXT BOOKS:
1. "ISDN Explained" John M.Griffiths 2nd Edition March 1995

John Willey & sons.
2. "Introduction to ATM Networking" Walter J. Goralski J. McGraw Hill Inc
3. "Computers and communications" Koji Kobayashi the MID Press 1986. (A version of c and C).

B2	NETWORK DESIGN

UNIT-I:
Essentials of Probability - Probability on a Sample Space, Basic Operations on Events, Probability on Events,Other Properties, Conditional Probability, Bayes Formula ,Independence, RandomVariables, Random Variable as a Measurement, Probability Mass Function for aRandom Variable, Cumulative Distribution Function, PMF and CDF for the 3 CoinToss Example, Expectation of a Random Variable, Important Random Variables,Bernoulli Random Variable, Binomial Random Variable, Geometric Random Variable, Poisson Random Variable, Continuous-valued Random Variables, Properties of Continuous Random Variables, Expectation of a Continuous Random Variable, Important Continuous Random Variable: Exponential, Memory less Property of the Exponential.

UNIT-II:
Delay Models in Data NetworksMultiplexing of Traffic on a Communication Link, Queuing Models- Little'sTheorem, Little's Theorem, Probabilistic Form of Little's Theorem, Application ofLittle's Theorem, The M/M/1 Queuing System, Arrival Statistics, Service Statistics,Markov Chain Formulation, Deviation of the Stationary Distribution, OccupancyDistribution upon Arrival, Occupancy Distribution upon Departure, The M/M/m,M/M/µ, M/M/m/m, AND Other Markov Systems, The M/M/m: The m-Server Case,M/M/µ: The Infinite-Server Case, M/M/m/m: The m-Server Loss System,ltidimensional Markov Chains- Applications in Circuit Switching, The M/G/1System, M/G/1 Queues with Vacations, Reservations and Polling, Priority Queuing

UNIT-III:
Inside an IMPQueuing in the Network Layer at an IMP, Basic Single Queue Model, Applicationsof Queuing Analysis Outside of Networking, The Poisson Arrival Model, Propertiesof a Poisson Process, Interarrival Times of a Poisson Process, The M/M/1 Queue,Aside: Queuing Notation, Aside: The D/D/1 Queue, State Analysis of an M/M/1 Queue, Balance Equations , Solving the Balance Equations, The Finite Buffer Case: M/M/1/N, Blocking Probability and the Right Size Buffer, Throughput in the Finite Buffer Case, Approximation of a Finite Buffer System by the Infinite Buffer Model, Little's Formula and Queuing Delay, Applying Little's Formula to an M/M/1 Queue, Applying the M/M/1 Results to a Single Network Link, Other Queuing Models

UNIT-IV:
Network Design - Problem definition: Multipoint line layout heuristics, CMST algorithm, ESAUWilliam'salgorithm, Sharma's algorithm, Unified algorithm, Bin packing, Terminalassignments, Concentrator location

UNIT-V:
Network Analysis:Queuing Networks, Closed Queuing Network Example, Nodes in a Packet SwitchedNetwork (PSN), Queuing Network Model of Nodes in a PSN, Queuing NetworkAnalysis of a PSN, performance analysis of Data Link Layer, Network layer, QoS,Network Administration:Functions and responsibilities, Network planning and implementation, Sub-netting,Bandwidth management, security issues, Tools for BW and security management,modifying network implementation.

REFERENCES:

1. Kershenbaum A., "Telecommunication Network Design Algorithms", Tata McGraw Hill
2. Keshav S., "An Engineering Approach to Computer Networking," Addison-Wesley,1997.
3. Bertsekas D. and Gallager R., "Data Networks," 2nd Ed., Prentice-Hall, Englewood Cliffs, N.J., 1992.
4. Vijay Ahuja, "Design and Analysis of Computer Communication Networks", McGraw Hill
5. Stallings W., "High Speed Networks and Internet : Performance and Quality of Service", Prentice-Hall
6. Zacker, "Networking – The Complete Reference", Tata McGraw Hill

B3	HIGH PERFORMANCE COMPUTING NETWORKS

UNIT I
HIGH SPEED NETWORKS: Frame Relay Networks – Asynchronous transfer mode – ATM Protocol Architecture, ATM logical Connection, ATM Cell – ATM Service Categories – AAL. High Speed LANs: Fast Ethernet, Gigabit Ethernet, Fiber Channel – Wireless LANs: applications, requirements – Architecture of 802.11

UNIT II
WDM OPTICAL NETWORKS: Introduction to Optical Networks – Wavelength Division Multiplexing (WDM) – Introduction to broadcast and select networks – switch architectures – channel accessing – Wavelength routed networks – switch architectures – Routing andwavelength assignment – Virtual topology design – IP over ATM over WDM – IP over WDM.

UNIT III
TCP, ATM CONGESTION CONTROL AND TRAFFIC MANAGEMENT
Queuing Analysis- Queuing Models – Single Server Queues – Effects of Congestion – Congestion Control – Traffic Management – Congestion Control in Packet Switching Networks – Frame Relay Congestion Control.TCP Flow control – TCP Congestion Control – Retransmission – Timer Management – Exponential RTO backoff – KARN's Algorithm – Window management – Performance of TCP over ATM. Traffic and Congestion control in ATM – Requirements – Attributes – Traffic Management

Frame work, Traffic Control – ABR traffic Management – ABR rate control, RM cell formats, ABR Capacity allocations – GFR traffic management.

UNIT IV
INTEGRATED AND DIFFERENTIATED SERVICES : Integrated Services Architecture – Approach, Components, Services- Queuing Discipline, FQ, PS, BRFQ, GPS, WFQ – Random Early Detection, Differentiated Services.

UNIT V
PROTOCOLS FOR QOS SUPPORT: RSVP – Goals & Characteristics, Data Flow, RSVP operations, Protocol Mechanisms – Multiprotocol Label Switching – Operations, Label Stacking, Protocol details – RTP – Protocol Architecture, Data Transfer Protocol, RTCP.

TEXT BOOK
1. William Stallings, "HIGH SPEED NETWORKS AND INTERNET", Pearson Education, Second Edition, 2002.

REFERENCES
1. Warland& Pravin Varaiya, "High Peerfoemance Communication Networks", Jean Harcourt Asia Pvt. Ltd., II Edition, 2001.
2. IrvanPepelnjk, Jim Guichard and Jeff Apcar, "MPLS and VPN architecture", Cisco Press, Volume 1 and 2, 2003.
3. C. Siva Ram Murthy and Mohan Gurusamy, "WDM Optical Networks: Concepts, Design and Algorithms", Prentice-Hall of India, 2002.
4. Fred Halsall, "Multimedia Communications – Applications, Networks, Protocols", Pearson Edition, 2001.

B4	PERVASIVE, GRID AND CLOUD COMPUTING

UNIT-I:
Pervasive Computing Infrastructure-Applications-Device Technology- Hardware, Human-Machine Interfaces, Biometrics, And Operating Systems- Device Connectivity-Protocols, Security , And Device Management-Pervasive Web Application Architecture-Access From PCs And PDAs- Access Via WAP

UNIT-II:
Grids and Grid Technologies, Programming models - A Look at a Grid Enabled Server and Parallelization Techniques – Grid applications- Grid architecture – Grid architecture and relationship to other Distributed Technologies – computational and data Grids, semantic grids

UNIT – III:
Grid Management systems, security, Grid Grid-Enabling software and Grid enabling network services, Data Grid - Virtualization Services for Data Grids, Peer-to-Peer Grids - Peer-to-Peer Grid Databases for Web Service Discovery and application execution.

UNIT-IV:

Introduction to Cloud Computing- Definition, Characteristics, Components- Cloud provider-Administering & Monitoring cloud services-benefits and limitations- Deploy application over cloud- Introduction to Cloud Technologies: SOAP,Webservices, AJAX and mashups, Virtualization Technology, Multitenant software.

UNIT-V:

Cloud Relational databases- Cloud file systems- Cloud computing security architecture- Cloud computing security challenges- Issues in cloud computing- Cloud Middleware- Mobile Cloud Computing- Inter Cloud issues.

TEXT BOOK:
1. Cloud Computing for Dummies by Judith Hurwitz, R.Bloor, M.Kanfman, F.Halper (Wiley India Edition),2010
2. Enterprise Cloud Computing by GautamShroff, Cambridge,2010.
3. Cloud Security by Ronald Krutz and Russell Dean Vines, Wiley-India,2010
4. Jochen Burkhardt, pervasive computing: Technology and Architecture of Mobile Internet Applications, Addison-Wesley Professional; 3rd edition, 2007

REFERENCES:
1. Fran Bermn, Geoffrey Fox, Anthony Hey J.G., "Grid Computing: Making the Global Infrastructure a Reality", Wiley, USA, 2003.
2. Joshy Joseph, Craig Fallenstein, "Grid Computing", Pearson Education, New Delhi, 2004.
3. Ian Foster, Carl Kesselman, "The Grid2: Blueprint for a New Computing Infrastructure". Morgan Kaufman, New Delhi, 2004.

4. Ahmar Abbas, "Grid Computing: Practical Guide to Technology andApplications", Delmar Thomson Learning, USA, 2004.

B5	MOBILE AND CELLULAR COMPUTING

UNIT I
WIRELESS COMMUNICATION FUNDAMENTALS
Introduction - Wireless transmission - Frequencies for radio transmission - Signals - Antennas - Signal Propagation - Multiplexing - Modulations - Spread spectrum - MAC - SDMA - FDMA - TDMA - CDMA - Cellular Wireless Networks.

UNIT II
TELECOMMUNICATION NETWORKS
Telecommunication systems - GSM - GPRS - DECT - Satellite Networks **-** Basics - Parameters and Configurations - Capacity Allocation - FAMA and DAMA - Broadcast Systems - DAB - DVB.

UNIT III

WIRLESS LAN
Wireless LAN - IEEE 802.11 - Architecture - services - MAC - Physical layer - IEEE 802.11a - HIPERLAN - Blue Tooth.

UNIT IV
MOBILE
NETWORK LAYER
Mobile IP - Dynamic Host Configuration Protocol - Routing - DSDV - DSR - Alternative Metrics.

UNIT V
 TRANSPORT AND APPLICATION LAYERS
Traditional TCP - Classical TCP improvements - WAP- Introduction to 4G mobile networks-Case study - Mobile multimedia networks.

Text Books
1. Jochen Schiller, "Mobile Communications", PHI/Pearson Education, Second Edition, 2003.
2. William Stallings, "Wireless Communications and Networks", PHI/Pearson Education, 2002.
3. Mobile cellular Telecommunications – W.C.Y.LEE, TMH, 2nd Edition, 2006.
4. Principles of mobile Communications – Gordon L. Stuber, Springer International, 2nd edition, 2007.
5. Wireless Communications – T.S.Rapport, Pearson Education, 2nd edition, 2002.

Reference Books
1. Wireless mobile Communications – Lee, McGrahill, 3rd Edition, 2006.
2. Wireless Communication and networking – J.W.Mark and WeihulaZhqung, PHI, 2005.
3. Wireless Communication Technology, R.Blake, Thompson Asia, Pvt Ltd, 2004.
4. Jochen Schiller, "Mobile Communications", PHI/Pearson Education, Second Edition, 2003.
5. William Stallings, "Wireless Communications and Networks", PHI/Pearson Education, 2002.
6. KavehPahlavan, PrasanthKrishnamoorthy, "Principles of Wireless Networks", PHI/Pearson Education, 2003.
7. Uwe Hansmann, LotharMerk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, New York, 2003.
8. HazysztofWesolowshi, "Mobile Communication Systems", John Wiley and Sons Ltd, 2002.

B6	NETWORK PROGRAMMING

UNIT I
Introduction to Systems Programming: Files, System Files, File Formats, Buffered I/O, Directories, File System, Inodes, links, fcntl, links, locks, Device I/O, Terminal I/O, ioctl(), Files and Devices ,Signals, video I/O ,Multi-Tasking

UNIT II
Processes and Inter-Process Communication: timers, polling vs interrupts, environment, fork, exec, wait, environment, exit and wait, pipe, fifos, message queues, semaphore

UNIT III
Network Programming: Sockets, Operation, Socket types, Domains Name Binding, osing Sockets, I/O Multiplexing, Client/Server Models, Connection Based Services,

UNIT IV
Handling out of Band Data, Connectionless Services, Design issues of Concurrent and Iterative servers, Socket options

UNIT V
XDR and Remote Procedure Calls, Network Programming at the level of Programming Language (can use Java or Python as case study)

TEXT BOOK:
1. Unix Network Programming, W. Richard Stevens, Prentice Hall, 1998

REFERENCES:
1. Internetworking with TCP/IP, Volume3, Douglas Comer, Prentice Hall, 2000
2. Internetworking with TCP/IP, Volume1, Douglas Comer, Prentice Hall, 2000

B7	NETWORK SECURITY

UNIT I
Introduction: Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security. Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques. Modern Techniques: Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations. Algorithms: Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST -128, RC2, Characteristics of Advanced Symmetric block ciphers.

UNIT II
Conventional Encryption: Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation. Public Key Cryptography: Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography.

UNIT III
Number theory: Prime and Relatively prime numbers, Modular arithmetic, Fermat's and Euler's Theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, discrete logarithms. Message authentication and Hash functions: Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.

UNIT IV

Hash and Mac Algorithms: MD File, Message digests Algorithm, Secure Hash Algorithm, RIPEMD- 160, and HMAC. Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards. Authentication Applications: Kerberos, X.509 directory Authentication service, Electronic Mail Security: Pretty Good Privacy, S/MIME.

UNIT V
IP Security: Over view, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management, Web Security: Web Security requirements, secure sockets layer and Transport layer security, Secure Electronic Transaction. Intruders, Viruses and Worms: Intruders, Viruses and Related threats, Fire Walls: Fire wall Design Principles, Trusted systems.

Text Books
1. William Stallings, Cryptography & Network Security: Principles and Practice, Pearson.
2. Stallings William, Network Security Essentials (Applications and Standards), Pearson Education.

Reference Books
1. Maiwald Eric, Fundamentals of Network Security, Dreamtech.

GROUP C: SUBJECTS FOR ELECTIVES UNDER SPECIALIZATION C

C1	BIG DATA ANALYTICS

UNIT I
INTRODUCTION TO BIG DATA: Introduction – distributed file system – Big Data and its importance, Four Vs, Drivers for Big data, Big data analytics, Big data applications. Algorithms using map reduce, Matrix-Vector Multiplication by Map Reduce.

UNIT II
INTRODUCTION HADOOP: Big Data – Apache Hadoop & Hadoop EcoSystem – Moving Data in and out of Hadoop – Understanding inputs and outputs of MapReduce - Data Serialization.

UNIT- III
HADOOP ARCHITECTURE: Hadoop Architecture, Hadoop Storage: HDFS, Common Hadoop Shell commands , Anatomy of File Write and Read., NameNode, Secondary NameNode, and DataNode, Hadoop MapReduce paradigm, Map and Reduce tasks, Job, Task trackers - Cluster Setup – SSH & Hadoop Configuration – HDFS Administering –Monitoring & Maintenance.

UNIT-IV
HADOOP ECOSYSTEM AND YARN : Hadoop ecosystem components - Schedulers - Fair and Capacity, Hadoop 2.0 New FeaturesNameNode High Availability, HDFS Federation, MRv2, YARN, Running MRv1 in YARN.

UNIT-V

HIVE AND HIVEQL, HBASE : Hive Architecture and Installation, Comparison with Traditional Database, HiveQL - Querying Data - Sorting And Aggregating, Map Reduce Scripts, Joins & Subqueries, HBase conceptsAdvanced Usage, Schema Design, Advance Indexing - PIG, Zookeeper - how it helps in monitoring a cluster, HBase uses Zookeeper and how to Build Applications with Zookeeper.

REFERENCES:

1. Boris lublinsky, Kevin t. Smith, Alexey Yakubovich, "Professional Hadoop Solutions", Wiley, ISBN: 9788126551071, 2015.
2. Chris Eaton, Dirk deroos et al., "Understanding Big data", McGraw Hill, 2012.
3. Tom White, "HADOOP: The definitive Guide", O Reilly 2012. 6 IT2015 SRM (E&T)
4. Vignesh Prajapati, "Big Data Analytics with R and Haoop", Packet Publishing 2013.
5. Tom Plunkett, Brian Macdonald et al, "Oracle Big Data Handbook", Oracle Press,   2014.
 6. http://www.bigdatauniversity.com/
 7. Jy Liebowitz, "Big Data and Business analytics",CRC press, 2013.

C2	PROGRAMMING FOR DATA ANALYTICS

UNIT I

 NETWORK PROGRAMMING & DISTRIBUTED OBJECTS Connecting to a Server - Implementing Servers and Clients- Advanced Socket Programming – InetAddress - URL Connections – RMI Programming.

UNIT II

 CONNECTING TO DATABASE The Design of JDBC - Basic Concepts - Executing Queries – Prepared Statemets - Result Sets – Metadata -Transactions.

UNIT III

 JAVABEANS The Bean - Writing Process - Using Beans to Build an Application - Bean Property Types – Property Editors - Customizers. 8 IT2015 SRM (E&T)

UNIT IV

 STREAMS AND FILES Streams – Text Input and Output – Reading and Writing Binary Data – Zip Archives – Object Streams and Serialization – Memory Mapped Files.

UNIT V

 PROGRAMMING MAP REDUCE MapReduce program in Java – Map Reduce API – Progamming Examples- Combiner Functions - Distributed MapReduce Job.

REFERENCES:

1. White, "Hadoop: The Definitive Guide", Third Edition - 2012 – O'Reilly – ISBN: 9789350237564.

2. Cay S. Horstmann, Gary Cornell, "Core Java™ 2: Volume II–Advanced Features",Prentice Hall, 9th edition, ISBN: 978-0137081608.

3. Jean Dollimore, Tim Kindberg, George Coulouris, "Distributed Systems Concepts and Design", 4th Edition, Jun 2005, Hardback, 944 pages, ISBN: 9780321263544.

4. Y. Daniel Liang, Introduction to Java Programming, Tenth Edition, Pearson, 2015.

C3	COMPUTING FOR DATA ANALYTICS

UNIT – I
DATA ANALYTICS LIFE CYCLE Introduction to Big data Business Analytics - State of the practice in analytics role of data scientists - Key roles for successful analytic project - Main phases of life cycle - Developing core deliverables for stakeholders.

UNIT – II
STATISTICS Sampling Techniques - Data classification, Tabulation, Frequency and Graphic reporesentation - Measures of central value - Arithmetic mean, Geometric mean, Harmonic mean, Mode, Median, Quartiles, Deciles, Percentile - Measures of variation – Range, IQR, Quartile deviation, Mean deviation, standard deviation, coefficient variance, skewness, Moments & Kurtosis.

UNIT – III
PROBABILITY AND HYPOTHESIS TESTING Random variable, distributions, two dimensional R.V, joint probability function, marginal density function. Random vectors - Some special probability distribution - Binomial, Poison, Geometric, uniform, exponential, normal, gamma and Erlang. Multivariate normal distribution - Sampling distribuition – Estimation - point, confidence - Test of significance, 1& 2 tailed test, uses of tdistribution, F-distribution, 2 distribution.

UNIT – IV
PREDICTIVE ANALYTICS Predictive modeling and Analyisis - Regression Analyisis, Multicollinearity , Correlation analysis, Rank correlation coefficient, Multiple correlation, Least square, Curve fitting and good ness of fit.

UNIT – V
TIME SERIES FORECASTING AND DESIGN OF EXPERIMENTS (9 hours) Forecasting Models for Time series : MA, SES, TS with trend, season - Design of Experiments, one way classification, two way classification, ANOVA, Latin square, Factorial Design.

REFERENCES:
1. Chris Eaton, Dirk Deroos, Tom Deutsch et al., "Understanding Big Data", McGrawHIll, 2012.
2. Alberto Cordoba, "Understanding the Predictive Analytics Lifecycle", Wiley, 2014.

3. Eric Siegel, Thomas H. Davenport, "Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die", Wiley, 2013.

4. James R Evans, "Business Analytics – Methods, Models and Decisions", Pearson 2013.

5. R. N. Prasad, Seema Acharya, "Fundamentals of Business Analytics", Wiley, 2015.

6. S M Ross, "Introduction to Probability and Statistics for Engineers and Scientists", Academic Foundation, 2011.

7. David Hand, Heiki Mannila, Padhria Smyth, "Principles of Data Mining", PHI 2013.

8. Spyros Makridakis, Steven C Wheelwright, Rob J Hyndman, "Forecasting methods and applications", Wiley 2013(Reprint).

9. David Hand, Heikki Mannila, Padhraic Smyth, "Principles of Data mining", PHI 2013. 10. http://cran.r-project.org/doc/manuals/R-intro.html 11. W.N. Venables, D.M Smith, "An introduction to R", 12. R in Nutshell, O Reilly,

C4	CLOUD COMPUTING

UNIT I-

CLOUD COMPUTING BASICS Cloud computing components- Infrastructure-services- storage applications-database services – Deployment models of Cloud- Services offered by Cloud- Benefits and Limitations of Cloud Computing – Issues in Cloud security- Cloud security services and design principles.

UNIT II-

VIRTUALIZATION FUNDAMENTALS   Virtualization – Enabling technology for cloud computing- Types of Virtualization- Server Virtualization- Desktop Virtualization – Memory Virtualization – Application and Storage Virtualization- Tools and Products available for Virtualization.

UNIT III-

SaaS and PaaS Getting started with SaaS- Understanding the multitenant nature of SaaS solutions- Understanding OpenSaaS Solutions- Understanding Service Oriented Architecture- PaaS- Benefits and Limitations of PaaS.

UNIT IV-

IaaS AND CLOUD DATA STORAGE Understanding IaaS- Improving performance through Load balancing- Server Types within IaaS solutions- Utilizing cloud based NAS devices – Understanding Cloud based data storage- Cloud based backup devices- Cloud based database solutions- Cloud based block storage.

UNIT V-

CLOUD APPLICATION DEVELOPMENT Client Server Distributed Architecture for cloud – Traditional apps vs. Cloud apps – Client side programming model: Web clients. Mobile clients-

Server Side Programming Technologies: AJAX, JSON, Web Services (RPC, REST)- MVC Design Patterns for Cloud Application Development.

REFERENCES BOOK:

1. Anthony T .Velte, Toby J.Velte, Robert Elsenpeter, "Cloud Computing: A Practical Approach", Tata McGraw Hill Edition, Fourth Reprint, 2010.
2. Kris Jamsa, "Cloud Computing: SaaS, PaaS, IaaS, Virtualization, Business Models, Mobile, Security and more", Jones & Bartlett Learning Company LLC, 2013.
3. Ronald L.Krutz, Russell vines, "Cloud Security: A Comprehensive Guide to Secure Cloud Computing", Wiley Publishing Inc., 2010.

C5	BIG DATA SECURITY

UNIT I
BIG DATA PRIVACY, ETHICS AND SECURITY Privacy – Reidentification of Anonymous People – Why Big Data Privacy is self-regulating? – Ethics – Ownership – Ethical Guidelines – Big Data Security – Organizational Security.

UNIT II
SECURITY, COMPLIANCE, AUDITING, AND PROTECTION Steps to secure big data – Classifying Data – Protecting – Big Data Compliance – Intellectual Property Challenge – Research Questions in Cloud Security – Open Problems.

UNIT III
HADOOP SECURITY DESIGN Kerberos – Default Hadoop Model without security - Hadoop Kerberos Security Implementation & Configuration.

UNIT IV
HADOOP ECOSYSTEM SECURITY Configuring Kerberos for Hadoop ecosystem components – Pig, Hive, Oozie, Flume, HBase, Sqoop.

UNIT V
DATA SECURITY & EVENT LOGGING Integrating Hadoop with Enterprise Security Systems - Securing Sensitive Data in Hadoop – SIEM system – Setting up audit logging in hadoop cluster

REFERENCES:

1. Mark Van Rijmenam, "Think Bigger: Developing a Successful Big Data Strategy for Your Business", Amazon, 1 edition, 2014.
2. Frank Ohlhorst John Wiley & Sons, "Big Data Analytics: Turning Big Data into Big Money", John Wiley & Sons, 2013.
3. Sherif Sakr, "Large Scale and Big Data: Processing and Management", CRC Press,   2014.

4. Sudeesh Narayanan, "Securing Hadoop", Packt Publishing, 2013.
5. Ben Spivey, Joey Echeverria, "Hadoop Security Protecting Your Big Data Problem", O'Reilly Media, 2015.
6. Top Tips for Securing Big Data Environments: e-book (http://www.ibmbigdatahub.com/whitepaper/top-tips-securing-big-data-environments-ebook)
7. http://www.dataguise.com/?q=securing-hadoop-discovering-and-securing-sensitive-Datahadoop-data-stores
8. Gazzang for Hadoophttp: // www.cloudera.com/ content/cloudera/ en/ solutions/Enterprise solutions / security-for-hadoop.html
9. eCryptfs for Hadoop https://launchpad.net/ecryptfs.
10. Project Rhino - https://github.com/intel-hadoop/project-rhino/

C6	SOFT COMPUTING

UNIT- I
Introduction: Soft computing paradigms - Neural network - Fuzzy logic - Derivation free optimization methods of genetic algorithms - Soft computing characteristics.

UNIT-II
Fuzzy Logic: Sets - properties - Arithmetics - Members function - Fuzzy relations - Relation equations - Fuzzy measures - Types of uncertainty - Memberes of uncertainties - Measures of fuzziness - Probabilities Vs Possibility - Measures of fuzzy events.

UNIT-III
Neural Computing: Neuronmodeling - learning in simple neuron - Perception learning curve - Proof - Limitations of perception

UNIT-IV
Neural Networks :Multi-level perception - Algorithm - Visualizing network behaviour - Self organizing network -Kohenen algorithm - Hopfield network - Adaptive resonance theory - Pattern classification.

UNIT -V
Gentic Algorithms: Introduction - Biological terminology - Search space and fitness landscapes - Elements of genetic algorithms - Genetic algorithms in problem solving.

REFERENCES:
1. Theory of Fuzzy subsets, Kauffmann a, Academic Press.
2. Neural Computing - An Introduction, R.BealeC.T.Jacson, Adam Hilge
3. An Introduction to Genetic Algorithms, Melanie Mitchell, PHI.

4. Neuro - Fuzzy and Soft Computing, JS Jang, C.T.Sun, E.Mizutani,, Matlab Curriculam Series, Prentice International.

5. Neural Networks-A Comprehensive foundation, Simon Haykin, Prentice Hall of India

C7	DATA MINING AND WAREHOUSING

UNIT I

Data mining – Introduction – Information and production factor – Data mining vs query tools– Data mining in marketing – Self learning computer systems – concept learning – Data mining and Data warehouse.

UNIT II

Knowledge discovery process: Data selection – Cleaning – Enrichment – Coding – Preliminary analysis of the data set using traditional query tools – Visualization techniques – OLAP tools – Decision trees – Association rules – Neural networks – Genetic Algorithms KDD (Knowledge discover in Database) environment.

UNIT III

Data warehouse Architecture: System Process – Process architecture – Design – Database scheme – Partitioning strategy – Aggregations – Data mart – Meta data – Systems and data Warehouse process managers.

UNIT IV

Hardware and operational design of data warehouses – Hardware architecture – Physical layout – security – Backup and recovery – Service level agreement – operating the data warehouse.

UNIT V

Planning, Tuning and Testing: Capacity planning – Tuning the data warehouse – Testing the data warehouses – Data warehouse features.

Text Books

1. Pieter Adriaans, Dolf Zantinge, Data Mining, Addison Wesley 1996

2. Sam Anahory, Dennis Muray, Data Warehousing in the real world, Addison Wesley 1996

3. Sean Kelly, Data WareHousing in Action, John Wiley 1997.

GROUP D: SUBJECTS FOR ELECTIVES UNDER SPECIALIZATION D

D1	MOBILE APPLICATION DEVELOPMENT

UNIT I   INTRODUCTION

Introduction to mobile applications – Embedded systems - Market and business drivers for mobile applications – Publishing and delivery of mobile applications – Requirements gathering and validation for mobile applications

UNIT II   BASIC DESIGN

Introduction – Basics of embedded systems design – Embedded OS - Design constraints for mobile applications, both hardware and software related – Architecting mobile applications – User interfaces for mobile applications – touch events and gestures – Achieving quality constraints – performance, usability, security, availability and modifiability.

UNIT III   ADVANCED DESIGN

Designing applications with multimedia and web access capabilities – Integration with GPS and social media networking applications – Accessing applications hosted in a cloud computing environment – Design patterns for mobile applications.

UNIT IV   TECHNOLOGY I - ANDROID

Introduction – Establishing the development environment – Android architecture – Activities and views – Interacting with UI – Persisting data using SQLite – Packaging and deployment – Interaction with server side applications – Using Google Maps, GPS and Wifi – Integration with social media applications.

UNIT V   TECHNOLOGY II - IOS

Introduction to Objective C – iOS features – U I implementation – Touch frameworks – Data persistence using Core Data and SQLite – Location aware applications using Core Location and Map Kit – Integrating calendar and address book with social media application – Using Wifi - iPhone marketplace.

REFERENCES:

1. http://developer.android.com/develop/index.html

2. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development",   Wrox, 2012

3. Charlie Collins, Michael Galpin and Matthias Kappler, "Android in Practice",   DreamTech, 2012

4. James Dovey and Ash Furrow, "Beginning Objective C", Apress, 2012

5. David Mark, Jack Nutting, Jeff LaMarche and Frederic Olsson, "Beginning iOS 6 Development: Exploring the iOS SDK", Apress, 2013.

D2	MOBILE COMPUTING

UNUNIT I INTRODUCTION

Mobile Computing – Mobile Computing Vs wireless Networking – Mobile Computing Applications – Characteristics of Mobile computing – Structure of Mobile Computing Application. MAC Protocols – Wireless MAC Issues – Fixed Assignment Schemes – Random Assignment Schemes – Reservation Based Schemes.

UNIT II MOBILE INTERNET PROTOCOL AND TRANSPORT LAYER

Overview of Mobile IP – Features of Mobile IP – Key Mechanism in Mobile IP – route Optimization. Overview of TCP/IP – Architecture of TCP/IP- Adaptation of TCP Window – Improvement in TCP Performance.

UNIT III   MOBILE TELECOMMUNICATION SYSTEM

Global System for Mobile Communication (GSM) – General Packet Radio Service (GPRS) – Universal Mobile Telecommunication System (UMTS).

UNIT IV MOBILE AD-HOC NETWORKS

Ad-Hoc Basic Concepts – Characteristics – Applications – Design Issues – Routing – Essential of Traditional Routing Protocols –Popular Routing Protocols – Vehicular Ad Hoc networks (VANET) – MANET Vs VANET – Security.

UNIT V MOBILE PLATFORMS AND APPLICATIONS

Mobile Device Operating Systems – Special Constrains & Requirements – Commercial Mobile Operating Systems – Software Development Kit: iOS, Android, BlackBerry, Windows Phone – MCommerce – Structure – Pros & Cons – Mobile Payment System – Security Issues.

TEXT BOOK:

1. Prasant Kumar Pattnaik, Rajib Mall, "Fundamentals of Mobile Computing", PHI   Learning Pvt. Ltd, New Delhi – 2012.
2. AULibrary.com

REFERENCES:

1. Jochen H. Schller, "Mobile Communications", Second Edition, Pearson Education, NewDelhi 2007.
2. Dharma Prakash Agarval, Qing and an Zeng, "Introduction to Wireless and Mobile Systems", Thomson Asia Pvt Ltd, 2005.
3. Uwe Hansmann, Lothar Merk, Martin S. Nicklons and Thomas Stober, "Principles of Mobile Computing", Springer, 2003.
4. William.C.Y.Lee,"Mobile Cellular Telecommunications-Analog and Digital Systems", Second Edition,Tata Mc Graw Hill Edition ,2006.
5. C.K.Toh, "AdHoc Mobile Wireless Networks", First Edition, Pearson Education,2002.
6. Android Developers: http://developer.android.com/index.html
7. Apple Developer: https://developer.apple.com/
8. Windows Phone Dev Center: http://developer.windowsphone.com

9. BlackBerry Developer: http://developer.blackberry.com/

D3	OPEN SOURCE SOFTWARE

UNIT I   INTRODUCTION
Introduction to Open sources – Need of Open Sources – Advantages of Open Sources–
Application of OpenSources. Open source operating systems: LINUX: Introduction – General
Overview – Kernel Mode and usermode – Process – Advanced Concepts – Scheduling –
Personalities – Cloning – Signals – Development withLinux. .

UNIT II   OPEN SOURCE DATABASE
MySQL: Introduction – Setting up account – Starting, terminating and writing your ownSQL
programs –Record selection Technology –Working with strings – Date and Time– Sorting Query
Results – GeneratingSummary – Working with metadata – Usingsequences – MySQL and Web.

UNIT III   OPEN SOURCE PROGRAMMING LANGUAGES
PHP: Introduction – Programming in web environment – variables – constants – data;types –
operators –Statements – Functions – Arrays – OOP – String Manipulation and regular expression
– File handling and datastorage – PHP and SQL database – PHP and LDAP – PHP Connectivity
– Sending and receiving E-mails –Debugging and error handling – Security – Templates.

UNIT IV   PYTHON
Syntax and Style – Python Objects – Numbers – Sequences – Strings – Lists and Tuples –
Dictionaries –Conditionals and Loops – Files – Input and Output – Errors and Exceptions –
Functions – Modules – Classes andOOP – Execution Environment.

UNIT V   PERL
Perl backgrounder – Perl overview – Perl parsing rules – Variables and Data – Statements and
Controlstructures – Subroutines, Packages, and Modules- Working with Files –Data
Manipulation.

TEXT BOOKS:
1. Remy Card, Eric Dumas and Frank Mevel, "The Linux Kernel Book", Wiley Publications,
     2003
2. Steve Suchring, "MySQL Bible", John Wiley, 2002.

References:

1. Rasmus Lerdorf and Levin Tatroe, "Programming PHP", O'Reilly, 2002.
2. Wesley J. Chun, "Core Phython Programming", Prentice Hall, 2001.
3.   Martin C. Brown, "Perl: The Complete Reference", 2nd Edition, Tata McGraw-Hill
     Publishing Company Limited, Indian Reprint 2009.
4. Steven Holzner, "PHP: The Complete Reference", 2nd Edition, Tata McGraw-Hill
     Publishing Company Limited, Indian Reprint 2009.
5.   Vikram Vaswani, "MYSQL: The Complete Reference", 2nd Edition, Tata McGraw- Hill
     Publishing CompanyLimited, Indian Reprint 2009.

D4	ANDROID MOBILE APPLICATION DEVELOPMENT

UNIT –I Introduction to Mobile Computing

Concept of Mobile Communication - Different generations of wireless technology - Basics of cell, cluster and frequency reuse concept - Noise and its effects on mobile - Understanding GSM and CDMA - Basics of GSM architecture and services like voice call, SMS, MMS, LBS, VAS - Different modes used for Mobile Communication - Architecture of Mobile Computing(3 tier) - Design considerations for mobile computing - Characteristics of Mobile Communication - Application of Mobile communication -Security Concern Related to Mobile Computing - Middleware and Gateway required for mobile Computing - Making Existing Application Mobile Enable - Mobile IP - Basic Mobile Computing Protocol - Mobile Communication via Satellite (Low orbit satellite, Medium orbit satellite, Geo stationary satellite, Satellite phones)

UNIT –II Introduction to Android

Overview of Android - What does Android run On - Android Internals? - Android for mobile apps development - Environment setup for Android apps Development - Framework - Android - SDK, Eclipse - Emulators –What is an Emulator / Android AVD

UNIT –III Android Activities and GUI Design Concepts

Design criteria for Android Application: Hardware Design Consideration, Design Demands For Android application, Intent, Activity, Activity Lifecycle and Manifest - Creating Application and new Activities - Simple UI - Layouts and Layout properties: Introduction to Android UI Design, Introducing Layouts - XML Introduction to GUI objects viz.: Push Button, Text / Labels, EditText, ToggleButton, Padding

UNIT –IV Advanced UI Programming

Event driven Programming in Android - (Text Edit, Button clicked etc.) - Activity Lifecycle of Android

UNIT –V

Toast, Menu, Dialog, List and Adapters Menu: Basics, Custom v/s System Menus, Create and Use Handset menu Button (Hardware) - Dialog: Creating and Altering Dialogs - Toast: List & Adapters - Demo Application Development and Launching - Basic operation of SQLite Database - Android Application Priorities

TEXT BOOK
1. Building Android Apps IN EASY STEPS McGraw - Hill Education
2. Professional Android 2 Application Development by Reto Meier, Wiley India Pvt Ltd
3. Beginning Android by Mark L Murphy,Wiley India Pvt Ltd
4. Pro Android, by Sayed Y Hashimi and Satya KomatineniWiley India Pvt Ltd.

D5	OPEN SOURCE TECHNOLOGIES

UNIT I
Introduction: Open Source, Free Software, Free Software vs. Open Source software, Public Domain Software, FOSS does not mean no cost. History: BSD, The Free Software Foundation and the GNU Project.

UNIT II
Open Source History, Initiatives, Principle and methodologies. Philosophy: Software Freedom, Open Source Development Model Licences and Patents: What Is A License, Important FOSS Licenses (Apache,BSD,GPL, LGPL), copyrights and copylefts, Patents Economics of FOSS : Zero Marginal Cost, Income-generation opportunities, Problems with traditional commercial software, Internationalization

UNIT III
Case Studies: Apache, BSD, Linux, Mozilla (Firefox), Wikipedia, Joomla, GCC, Open Office.

UNIT IV
Starting and Maintaining an Open Source Project, Open Source Hardware, Open Source Design, Open source Teaching. And Open source media.

UNIT V
Open source vs. closed source Open source government, Open source ethics. Social and Financial impacts of open source technology, Shared software, Shared source

REFERENCE BOOK
1. Andrew M. Laurent. St (2004). Understanding open source and free software licensing. 1st edition, O'Reilly Media, Inc.
2. Feller Joseph (2005). Perspectives on Free and Open Source Software. MIT press. Edition-illustrated.
3. Andrew M. Laurent. St (2004), Understanding open source and free software licensing.
4. Kirk St. Amant, Still Brian. (2007). Handbook of research on open source software: technological, economic, and social perspectives.
5. Agerfalk Par J, Boldyreff Cornelia, Jesus M. Barahona -Gonzalez (2010). Open Source Software. New Horizons.
6. Michael R. Overly, Pike and Fischer (2003). The Open Source Handbook. Inc, Pike & Fischer – A BNA Company.
7. Dixon Rod (2004), Open source software law.
8. Ludvig A, Norin, Fredrik Stockel, Sweden (1998-05-20), Open-Source Software Development Methodology.

D6	MOBILE AND WIRELESS SECURITY

UNIT I - INTRODUCTION

Security and Privacy for Mobile and Wireless Networks: Introduction- State of the Art-   Areas for   Future   Research- General Recommendation for   Research. Pervasive   Systems: Enhancing Trust Negotiation with Privacy Support: Trust Negotiation- Weakness   of Trust Negotiation- Extending Trust Negotiation to Support Privacy

UNIT II - MOBILE SECURITY

Mobile system architectures, Overview of mobile cellular systems, GSM and UMTS Security &   Attacks, Vulnerabilities in Cellular Services, Cellular Jamming Attacks   & Mitigation, Security in Cellular VoIP Services, Mobile application security.

UNIT III - SECURING WIRELESS NETWORKS

Overview of Wireless security, Scanning and Enumerating 802.11 Networks, Attacking 802.11 Networks, Attacking WPA protected 802.11 Networks, Bluetooth Scanning and Reconnaissance, Bluetooth Eavesdropping, Attacking and Exploiting Bluetooth, Zigbee Security, Zigbee Attacks

UNIT IV - ADHOC NETWORK SECURITY

Security   in Ad Hoc   Wireless   Networks, Network Security   Requirements,   Issues and Challenges   in   Security   Provisioning,   Network   Security   Attacks,   Key Management in Adhoc Wireless Networks, Secure Routing in   Adhoc Wireless Networks

UNIT V-RFID SECURITY

Introduction, RFID Security and privacy, RFID chips Techniques and Protocols, RFID anti-counterfeiting, Man-in-the-middle attacks on RFID systems, Digital Signature Transponder, Combining Physics and Cryptography to Enhance Privacy in RFID Systems, Scalability Issues in Large-Scale Applications, An Efficient and Secure RFID Security Method with Ownership Transfer, Policy-based Dynamic Privacy Protection Framework leveraging Globally Mobile RFIDs, User-Centric Security for RFID based Distributed Systems, Optimizing RFID protocols for Low Information Leakage, RFID: an anti-counterfeiting tool.

REFERENCES BOOK:

1.   Kia Makki, Peter Reiher, "Mobile and Wireless Network Security and Privacy ", Springer, ISBN 978-0-387-71057-0, 2007.
2.   C. Siva Ram Murthy, B.S. Manoj, "Adhoc Wireless Networks Architectures and Protocols", Prentice Hall, x ISBN 9788131706885, 2007.
3.   NoureddineBoudriga,   "Security   of   Mobile   Communications", ISBN 9780849379413, 2010.
4.   Kitsos, Paris; Zhang, Yan, "RFID   Security Techniques, Protocols and System-On-Chip Design ", ISBN 978-0-387-76481-8, 2008.
5.   Johny Cache, Joshua Wright and Vincent Liu," Hacking Wireless Exposed: Wireless Security Secrets & Solutions ", second edition, McGraw Hill, ISBN: 978-0-07- 166662-6, 2010.

D7	MOBILE AND DIGITAL FORENSICS

UNIT – I – INTRODUCTION TO WIRELESS TECHNOLOGIES

Overview of wireless technologies and security: Personal Area Networks, Wireless Local Area Networks, Metropolitan Area Networks, Wide Area Networks. Wireless threats, vulnerabilities and security: Wireless LANs, War Driving, War Chalking, War Flying, Common Wi-fi security recommendations, PDA Security, Cell Phones and Security, Wireless DoS attacks, GPS Jamming, Identity theft.

UNIT - II – SECURITY FRAMEWORK FOR MOBILE SYSTEMS

CIA triad in mobile phones-Voice, SMS and Identification data interception in GSM: Introduction, practical setup and tools, implementation- Software and Hardware Mobile phone tricks: Netmonitor, GSM network service codes, mobile phone codes, catalog tricks and AT command set- SMS security issues.

UNIT - III - MOBILE PHONE FORENSICS

Crime and mobile phones, evidences, forensic procedures, files present in SIM card, device data, external memory dump, and evidences in memory card, operators systems- Android forensics: Procedures for handling an android device, imaging android USB mass storage devices, logical and physical techniques.

UNIT - IV – INTRODUCTION TO DIGITAL FORENSICS

Digital forensics: Introduction – Evidential potential of digital devices: closed vs. open systems, evaluating digital evidence potential- Device handling: seizure issues, device identification, networked devices and contamination.

UNIT - V – ANALYSIS OF DIGITAL FORENSIC TECHNIQUES

Digital forensics examination principles: Previewing, imaging, continuity, hashing and evidence locations- Seven element security model- developmental model of digital systems- audit and logs- Evidence interpretation: Data content and context.

REFERENCES BOOK:

1. Gregory Kipper, "Wireless Crime and Forensic Investigation", Auerbach Publications, 2007.
2. Iosif I. Androulidakis, "Mobile phone security and forensics: A practical Approach", Springer publications, 2012.
3. Andrew Hoog, "Android Forensics: Investigation, Analysis and Mobile Security for Google Android", Elsevier publications, 2011.

4. Angus M.Marshall, " Digital forensics: Digital evidence in criminal Investigation", John – Wiley and Sons, 2008.